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PATENT SPECIFICATION

(11) 1 586 441

(21) Application No. 678/77 (22) Filed 8 Jan. 1977
(23) Complete Specification Filed 6 Dec. 1977
(44) Complete Specification Published 18 Mar. 1981
(51) INT. CL.[3] H03G 3/20
(52) Index at Acceptance
H3G SE
(72) Inventor: ROBERT GEORGE ELEY

(19)

(54) IMPROVEMENTS IN OR RELATING TO LOUDSPEAKER SYSTEMS

(71) We, THE MARCONI COMPANY LIMITED, a British Company of Marconi House, New Street, Chelmsford, Essex CM1 1PL, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement.

This invention relates to loudspeaker systems.

The amount of sound required to emanate from a loudspeaker depends to a large extent on the ambient noise in the vicinity of the speaker. It is, of course, not uncommon to provide loudspeakers with some form of manual volume control whereby the level of the audio frequency signal applied to the speaker may be reduced when the loudspeaker is in a quiet vicinity and increased if the ambient noise level increases. The use of a manual volume control, apart from the attention required to be given to it by an operator, may be satisfactory where one or more loudspeakers are operated in the same vicinity as the operator, but, for a public address system for example, manual adjustment of the level of output of different speakers in different localities in dependence upon the ambient noise level is impracticable.

One object of the present invention is to provide an improved loudspeaker system in which the volume of sound produced by a loudspeaker is directly related to the noise level in the vicinity of that speaker.

According to one aspect of this invention a monitoring and control system for a loudspeaker comprises means for adjusting the level of audio frequency signals to be applied to said speaker, means for detecting the level of noise received by said speaker when operating as a microphone and means for controlling said audio frequency signal level adjusting means in dependence upon the output of said noise level detecting means whereby in operation the volume of sound produced by said loudspeaker is directly related to the noise level in the vicinity of that speaker.

A loudspeaker system in accordance with the present invention comprises at least one loudspeaker and, for the or each loudspeaker, a monitoring and control system as described above.

Preferably said monitoring and control system comprises an audio frequency signal input terminal connected via an audio frequency signal level controller to an output terminal provided for connection to a loudspeaker, means for detecting the level of noise received by said loudspeaker when, in the absence of an audio frequency signal input at said input terminal said loudspeaker operates as a microphone, means for storing a signal representative of said last mentioned detected level of noise and means for utilising said stored signal to control the adjustment of said audio frequency signal level controller.

Preferably means are provided for detecting the presence or absence of audio frequency signals at said input terminal for determining when said storage means is up-dated.

Said last mentioned detecting means may comprise an amplitude threshold detector.

Preferably said last mentioned detecting means is connected to control a switch which connects said loudspeaker either to the output of said audio frequency signal level controller, when an audio signal input is present, or to the input of a noise level detector, when an audio frequency signal input is absent and said loudspeaker is operating as a microphone, said last mentioned detecting means being also connected to control said storage means whereby the control signal stored thereby is up-dated in dependence upon the current

level of noise detected by said noise level detector.

In a system employing a plurality of loudspeakers, such as a public address system, the monitoring and control system provided in respect of each loudspeaker may be located either at a centralised position or the monitoring and control system for each loudspeaker may be provided adjacent its loudspeaker.

The invention is illustrated in and further described with reference to the drawing accompanying the provisional specification in which,

Figure 1 is a block schematic circuit diagram of one monitoring and control system provided for one loudspeaker, in accordance with the present invention and

Figures 2 and *3* schematically illustrate different loudspeaker systems in accordance with the present invention.

Referring to Figure 1, the monitoring and control system for the, or each if a plurality is provided, loudspeaker 1 is shown within dashed line block 2. It is assumed that the loudspeaker is to operate to reproduce audio frequency signals appearing on an input terminal 3. Input terminal 3 is connected to the input of an audio frequency signal level controller 4, controlled as hereinafter described, the output controller 4, controlled as hereinafter described, the output terminal of which is connected to one of two alternative contacts of a two way switch 5. The permanent contact of two way switch 5 is connected to the loudspeaker 1. The other of the two alternative contacts of two way switch 5 is connected to the input of a noise level detector 6, whose output is applied to a level memory store 7. Level memory store 7 is connected to provide control for the audio frequency signal level controller 4.

Two way switch 5 is controlled by an audio frequency signal detector 8, which is in the form of a threshold detecting circuit connected to the input terminal 3 so as to provide an output when the audio signals applied to terminal 3 cease, or rather fall below a predetermined amplitude threshold level. The output of audio frequency signal detector 8 is also connected to the level memory store 7 to control the up-dating of that store.

The whole arrangement is such that when audio frequency signals above the predetermined amplitude threshold are present at input terminal 3, switch 5 is in the position shown such that the output of audio frequency signal level controller 4 is connected through the switch 5 to the loudspeaker 1, which reproduces the audio frequency signal with a volume dependent upon the control signal stored in level memory store 7.

When the audio frequency signals applied to terminal 3 cease (e.g. in a public address system as an annoucement finishes), so audio frequency signal detector 8 provides a signal which switches 5 to its other position and prepares level memory store 7 for up-dating. With the switch 5 now in its other position, loudspeaker 1 is connected to noise level detector 6, which latter provides a signal for storage in level memory store 7 which depends upon the noise level in the vicinity of the speaker 1, which is now acting as a microphone.

As audio frequency signals again appear at terminal 3 (i.e. at the beginning of the next annoucement in a public address system), the output of audio frequency signal detector 8 changes and switch 5 reverts to the first mentioned position as shown and the control signal stored in level memory store 7 remains that which is appropriate to the noise level in the vicinity of the speaker 1 immediately before the fresh audio signals appeared on terminal 3.

In a modification, which is suitable in applications where the operation of the loudspeaker is more continuous than is normally the case with public address systems, the supply of audio signals at terminal 3 is interrupted periodically in order to permit the level memory store 7 to be up-dated.

Referring to Figure 2, this illustrates a public address system having a plurality, in this case three, of distributed loudspeakers 1A, 1B and 1C and for each of the loudspeakers 1A, 1B and 1C a monitoring and control system 2A, 2B and 2C respectively is provided. In this case the monitoring and control systems 2A, 2B and 2C are housed in a central position, represented by the dashed line block 9, remote from the loudspeakers 1A, 1B and 1C.

Referring to Figure 3, in this example each of the monitoring and control systems 2A, 2B and 2C for the loudspeakers 1A, 1B and 1C is housed adjacent its respective loudspeaker.

WHAT WE CLAIM IS:-

1. A monitoring and control system for a loudspeaker comprising means for adjusting the level of audio frequency signals to be applied to said speaker, means for detecting the level of noise received by said speaker when operating as a microphone and means for controlling said audio frequency signal level adjusting means in dependence upon the output of said noise level detecting means whereby in operation the volume of sound produced by said loudspeaker is directly related to the noise level in the vicinity of that speaker.

2. A loudspeaker system comprising at least one loudspeaker and, for the or each loudspeaker, a monitoring and control system as claimed in claim 1.

3. A system as claimed in claim 1 or 2 wherein said monitoring and control system comprises an audio frequency signal input terminal connected via an audio frequency signal level controller to an output terminal provided for connection to a loudspeaker, means for detecting the level of noise received by said loudspeaker when, in the absence of an audio frequency signal input at said input terminal said loudspeaker operates as a microphone, means for storing a signal representative of said last mentioned detecting level of noise and means for utilising said stored signal to control the adjustment of said audio frequency signal level controller.

4. A system as claimed in claim 3 and wherein means are provided for detecting the presence or absence of audio frequency signals at said input terminal for determining when said storage means is up-dated.

5. A system as claimed in claim 4 and wherein said last mentioned detecting means comprises an amplitude threshold detector.

6. A system as claimed in claim 5 and wherein said last mentioned detecting means is connected to control a switch which connects said loudspeaker either to the output of said audio frequency signal level controller, when an audio signal input is present, or to the input of a noise level detector, when an audio frequency signal input is absent and said loudspeaker is operating as a microphone, said last mentioned detecting means being also connected to control said storage means whereby the control signal stored thereby is up-dated in dependence upon the current level of noise detected by said noise level detector.

7. A loudspeaker system as claimed in any of the above claims and employing a plurality of loudspeakers, the monitoring and control system provided in respect of each loudspeaker being located at a centralised position.

8. A loudspeaker system as claimed in any of the above claims 1 to 6 and employing a plurality of loudspeakers, the monitoring and control system provided in respect of each loudspeaker being provided adjacent its loudspeaker.

9. A monitoring and control system substantially as herein described with reference to Figure 1 of the drawing accompanying the provisional specification.

10. A loudspeaker system substantially as herein described with reference to Figure 2 of the drawing accompanying the provisional specification.

11. A loudspeaker system substantially as herein described with reference to Figure 3 of the drawing accompanying the provisional specification.

D. G. ROUSE,
Chartered Patent Agent,
Marconi House, New Street,
Chelmsford, Essex CM1 1PL.
Agent for the Applicants.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company Limited, Croydon, Surrey, 1981.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

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1 SHEET

This drawing is a reproduction of the Original on a reduced scale

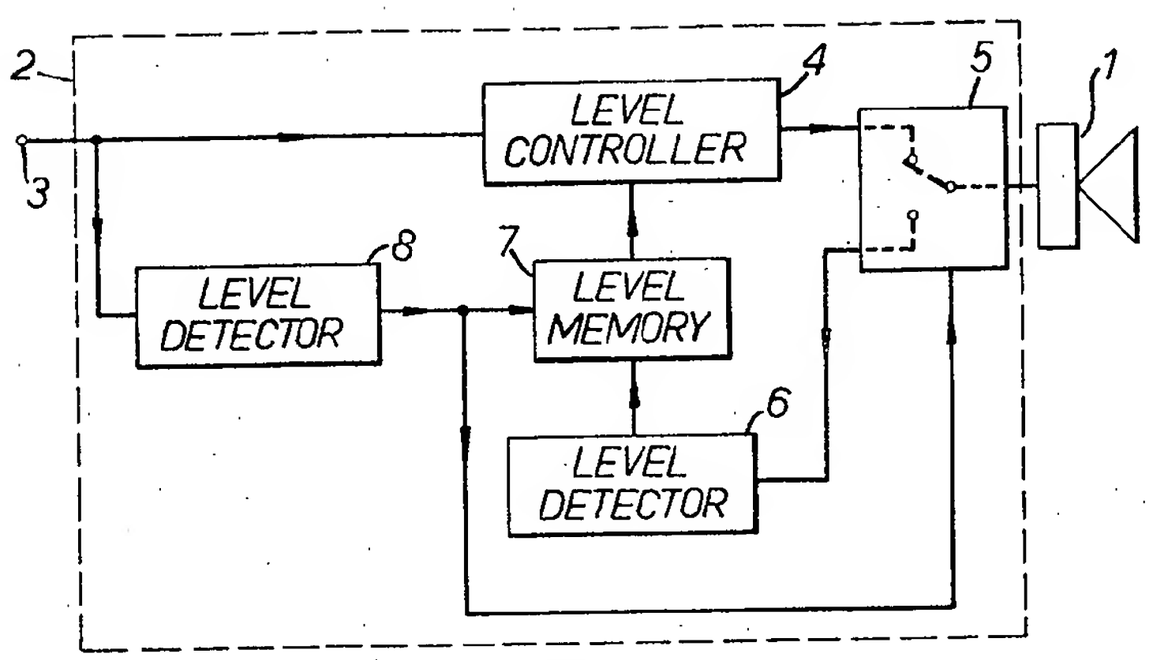

FIG. 1.

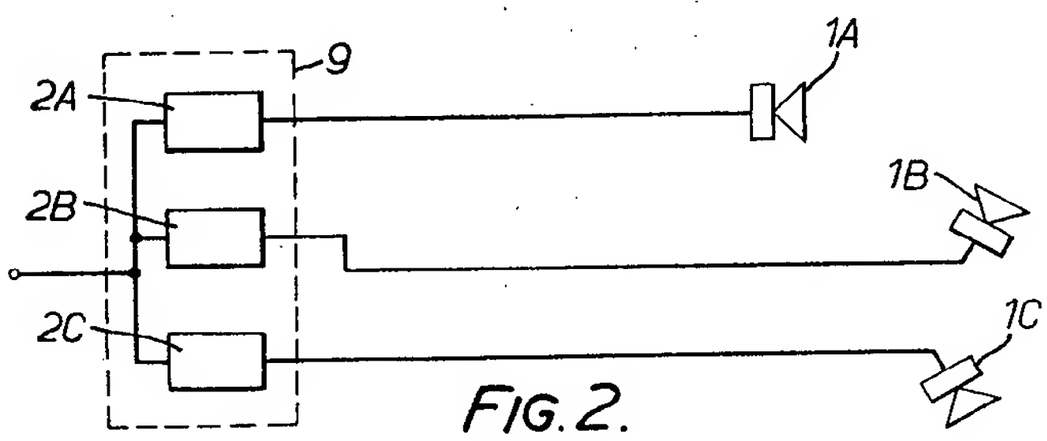

FIG. 2.

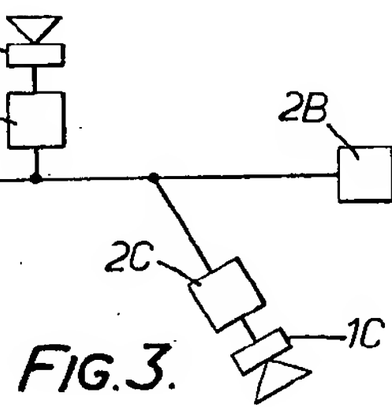

FIG. 3.